PATENT
Docket No.: B-1482-CIP2

**AFTER FINAL**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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| In re Application of: | : | |
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| Wang et al. | : | |
| | : | |
| Application No. 10/076,881 | : | Art Unit: 1764 |
| | : | |
| Filed: Feb. 13, 2002 | : | Examiner: Thuan D. Dang |
| | : | |
| For: METHOD AND CATALYST STRUCTURE FOR STEAM REFORMING OF A HYDROCARBON | : | Conf. No. 1025 |
| | : | |
| | : | Atty Docket: B-1482-CIP2 |
| | : | |

***BRIEF ON APPEAL***

Board of Patent Appeals and Interferences
Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

This Appeal Brief is submitted in accordance with the terms of 35 U.S.C. § 134 and 37 C.F.R. § 1.192 in response to the Advisory Action mailed Jan. 30, 2007. The $500 processing fee (37 C.F.R. § 41.20(b)(2)) and the fee for a one month time extension are provided in documents accompanying this Brief; any additional fees required for consideration of this paper can be charged to deposit account 50-1749.

## I. Real Party In Interest

Battelle Memorial Institute headquartered in Columbus, Ohio, is the real party in interest.

## II. Related Appeals and Interferences

None.

## III. Status of Claims

Claims 1-58 are pending. Claims 1-4, 6-46, and 49-58 have been provisionally rejected on the ground of obviousness-type double patenting over claims 1-8 of copending application ser. no. 10/778904 and are the subject of this appeal.

## IV. Status of Amendments

An Amendment filed after the First Office Action was entered. No other amendments were filed. In particular, no amendments were filed subsequent to the Final Office Action or the Advisory Action.

## V. Summary of the Claimed Subject Matter

The independent claims are 1 and 12. The claims all relate to a method of steam reforming. Claim 1 recites certain surface active site materials, a short contact time in a reaction chamber, and a hydrocarbon conversion of at least 50%. Claim 12 recites a catalyst structure with a large pore support, a smaller pore interfacial layer disposed over the support and a catalyst metal. Claim 12 was originally filed in the application. Support in the specification for claim 1 can generally be found at page 2, lines 12-19. Discussion of large pore supports can be found at page 5, lines 15-29, with particular support at lines 19-20. Short contact times are described at page 7, lines 3-7.

Claim 16 was originally filed in the application and recites a method of steam reforming in which steam and hydrocarbon are passed through a reaction chamber comprising a catalyst with a pore volume of 30 to 95% and in which at least 50% of the catalyst's pore volume is composed of pores in the size range of 0.3 to 200 microns. Support in the specification for claim 16 can be found at page 2, lines 9-11; page 5, line 31 – page 6, line 2.

## VI. Grounds Of Rejection To Be Reviewed On Appeal

1. Appellant is seeking review of the provisional rejection of claims 1-4, 6-46, and 49-58 on the ground of obviousness-type double patenting over claims 1-8 of copending application ser. no. 10/778904.

## VII. Argument

**I. The Rejection is Improper Because, In This Situation, A Two-Way Test Is Required. And, Since the Claims Are Not Obvious Under the Two-Way Test, the Rejection Should Be Withdrawn.**

This type of obviousness double-patenting, in which the claims of an earlier-filed application are held to be obvious in view of a later filed application, requires a showing of two-way obviousness. The standards for when a two-way test is set forth in MPEP § 804B.1. A two-way test is applied when (1) the applicant could not have filed the material in the same application, and (2) the Patent Office caused the delay in issuing the earlier-filed application.

Applicants could not have filed the material in the same application. This application was filed on February 13, 2002. The '904 copending application was filed on February 13, 2004. The applicant could not have filed the claims of the '904 copending application in this application, because the invention that is described in the claims of the '904 application did not exist on February 13, 2002. The Examiner has not disputed this statement. Thus, it would have been impossible for Applicants to have filed the claims of the '904 application in this application.

The delay in issuing the earlier-filed application was caused by the Patent Office. The first Office Action in this application was not mailed until July 21, 2003. That is over 17 months before even the first Office Action was mailed. This first Office Action was written by Examiner Yildirim. Applicants amended some claims and mailed their Amendment on December 19, 2003. Nearly a year later, on December 3, 2004, the Patent Office mailed a notice refusing entry of the amendment on the ground that Applicants identified the added claims as "(Currently Added)" rather than "(New)." Ten days later, on December 13, 2004, Applicants corrected the claim identifier and submitted the corrected amendment. Applicants first amendment overcame all the pending grounds of rejection; however, on Mar 3, 2005, a new examiner, Examiner Griffin issued a final Office Action withdrawing all prior rejections but containing new grounds of rejection. In summary, during the two years between the filing of this application and the filing of the subsequent application, the Patent Office issued only one Office Action and Applicants filed a reply that overcame the rejections in the first Office Action. The 17+ month delay before issuing a first Office Action was caused entirely by the Patent Office. Applicants responded with an Amendment that overcame the rejections of that first Office Action. In these circumstances, where the Patent Office waited over 17 months to issue a first Office Action, and nearly a year more for the Patent Office's response to Applicants first amendment, it would have been

impossible for applicants to have obtained an issued patent prior to the February 2004 filing date of the later-filed application. Thus, the Patent Office has caused the delay in issuing this earlier-filed application.

Accordingly, the two-way test must be applied.

The two-way test has not been applied. Therefore, the rejection is improper. Furthermore, since the pending claims are not two-way obvious over the claims of the copending '904 application, the rejection should be withdrawn.

**II. Even Using a One-Way Test For Obviousness, The Claimed Invention Is Not Obvious Over Claims 1-8 of the '904 Application.**

Secondly, even if only a one way test of obviousness is applied, the claimed invention is not obvious over claims 1-8 of the '904 application. The Office Action states:

"The claims of 10/778904 do not include the limitations regarding catalyst characteristics. However, the portions of the 10/778994 specification that provide support for the catalyst limitations disclose catalyst having similar features as claimed in the present application."

This is not true. The limitations in the present claims (i.e., catalyst pore structure, etc.) are not found in the portions of the '904 specification that provide support for claims 1-8 of the '904 application. For example, claim 12 (and all the claims dependent on claim 12), which is separately patentable from claim 1, recites a large pore (greater than 0.1 μm) support, an interfacial layer, and an active catalyst site. Claims 1-8 mention only a stabilized alumina support and a catalytically active material; claims 1-8 of the '904 application do not contain any mention of a large pore support or an interfacial layer. Since the claims do not even mention these features, there cannot be a question whether the '904 specification provides support for catalyst limitations that do not exist in the claims. Therefore, even if only a one-way test is applied, the claimed invention is not obvious over claims 1-8 of the '904 specification.

**III. According to the MPEP The Rejection Must Be Withdrawn**

The MPEP is clear that the rejection must be withdrawn. Here is the entire extended except from MPEP §804:

The "provisional" double patenting rejection should continue to be made by the examiner in each application as long as there are conflicting claims in more than one

application unless that "provisional" double patenting rejection is the only rejection remaining in at least one of the applications.

## 1. Nonstatutory Double Patenting Rejections

If a "provisional" nonstatutory obviousness-type double patenting (ODP) rejection is the only rejection remaining in the earlier filed of the two pending applications, while the later-filed application is rejectable on other grounds, the examiner should withdraw that rejection and permit the earlier-filed application to issue as a patent without a terminal disclaimer. If the ODP rejection is the only rejection remaining in the later-filed application, while the earlier-filed application is rejectable on other grounds, a terminal disclaimer must be required in the later-filed application before the rejection can be withdrawn.

If "provisional" ODP rejections in two applications are the only rejections remaining in those applications, the examiner should withdraw the ODP rejection in the earlier filed application thereby permitting that application to issue without need of a terminal disclaimer. A terminal disclaimer must be required in the later-filed application before the ODP rejection can be withdrawn and the application permitted to issue. If both applications are filed on the same day, the examiner should determine which application claims the base invention and which application claims the improvement (added limitations). The ODP rejection in the base application can be withdrawn without a terminal disclaimer, while the ODP rejection in the improvement application cannot be withdrawn without a terminal disclaimer.

As can be seen in the underlined portion of the extended excerpt, in cases such as the present case, where the provisional rejection is the only rejection in at least one of the patents, the rejection must be withdrawn.

The Examiner has argued that the rejection should be withdrawn only when the later-filed application is rejectable on other grounds. However, the MPEP does not say that the rejection should be maintained when the later-filed application is rejectable on other grounds. To the contrary, as shown in the underlined section, the MPEP clearly states that the rejection should not be maintained when that rejection is the only rejection remaining in at least one of the applications. Since the provisional rejection is the only rejection remaining in at least one of the applications, the rejection must be withdrawn.

**IV. The Examiner's Basis For the Rejection Will Likely Disappear During Pendency of This Appeal.**

The Examiner's basis for this rejection will probably disappear during the pendency of this appeal. Thus far, there has not been an Office Action in the '904 copending application. If an

Office Action issues in the '904 copending application and claims 1-8 are rejected, or if a restriction requirement is issued and claims 1-8 are canceled (without prejudice toward refiling such claims in a later-filed divisional application) and are not copending, then the basis for this rejection will disappear.

Therefore, once an Office Action is issued in the '904 copending application, the Patent Office should immediately withdraw the rejection.

## Conclusion

For the foregoing reasons, appellants respectfully submit that the Examiner has erred in rejecting this application. Please reverse the rejections discussed above.

Dated this 9th day of April, 2007.

Respectfully submitted,

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## VII. CLAIMS APPENDIX

1. (previously presented) A method of steam reforming, comprising:

passing steam and hydrocarbon through a reaction chamber;

wherein the reaction chamber comprises a catalyst that has surface active sites comprising a material selected from the group consisting of rhodium, iridium, nickel, palladium, platinum, ruthenium, carbide of group VIb and combinations thereof;

wherein the rate of said passing steam and hydrocarbon is controlled such that contact time in the reaction chamber is less than 0.1 seconds;

wherein, after passing through the reaction chamber, the hydrocarbon conversion has reached at least 50% of equilibrium conversion.

2. (previously presented) The method of claim 1 wherein the reaction chamber comprises a catalyst that has surface active sites comprising a material selected from the group consisting of rhodium, iridium, nickel, palladium, platinum, and combinations thereof.

3. (original) The method of claim 2 wherein the temperature in the reaction chamber is in the range of 500 °C to 1000 °C;

4. (original) The method of claim 2 wherein the catalyst comprises a spinel support.

5. (original) The method of claim 1 wherein the catalyst comprises a zirconia support.

6. (original) The method of claim 3 wherein the catalyst comprises:

a first porous structure with a first pore surface area and a first pore size of at least 0.1 μm; and

a porous interfacial layer with a second pore surface area and a second pore size that is less than the first pore size.

7. (original) The method of claim 6 wherein the porous interfacial layer comprises a spinel.

8. (original) The method of claim 6 wherein the first porous structure comprises a metal foam or metal felt, and the porous interfacial layer comprises alumina.

9. (original) The method of claim 1 wherein the catalyst has a pore volume of 30 to 95% and at least 50% of the catalyst's pore volume is composed of pores in the size range of 0.3 to 200 microns.

10. (original) The method of claim 3 wherein the hydrocarbon is converted to at least 90% of equilibrium conversion and hydrogen selectivity is at least 85%.

11. (original) The method of claim 10 wherein the catalyst comprises surface active sites comprising Rh.

12. (original) A method of steam reforming, comprising:

passing steam and hydrocarbon through a reaction chamber;

wherein the reaction chamber comprises a catalyst;

wherein the catalyst comprises:

a first porous structure with a first pore surface area and a first pore size of at least 0.1 μm;

a porous interfacial layer with a second pore surface area and a second pore size that is less than the first pore size; and

a catalyst metal.

13. (original) The method of claim 12 wherein the rate of said passing steam and hydrocarbon is controlled such that residence time in the reaction chamber is less than about 0.1 seconds;

wherein at least 50% of said hydrocarbon has been converted to products after passing through the reaction chamber.

14. (original) The method of claim 13 wherein the catalyst that has surface active sites comprising a material selected from the group consisting of rhodium, iridium, nickel, palladium, platinum, and combinations thereof.

15. (previously presented) The method of claim 13 wherein the porous interfacial layer comprises a material selected from the group consisting of alumina and spinel.

16. (original) A method of steam reforming, comprising:

passing steam and hydrocarbon through a reaction chamber;

wherein the reaction chamber comprises a catalyst;

wherein the catalyst comprises:

catalyst has a pore volume of 30 to 95% and at least 50% of the catalyst's pore volume is composed of pores in the size range of 0.3 to 200 microns; and

a catalyst metal.

17. (original) The method of claim 12 wherein the rate of said passing steam and hydrocarbon is controlled such that contact time in the reaction chamber is in the range of 5 to 100 milliseconds; and

wherein, after passing through the reaction chamber, the hydrocarbon conversion has reached at least 50% of equilibrium conversion.

18. (original) The method of claim 16 wherein the catalyst has a hydrogen productivity of at least 0.7 $mmol \cdot s^{-1} \cdot cm^{-3}$.

19. (original) The method of claim 11 having a hydrogen productivity of between 0.5 and 2 $mmol \cdot s^{-1} \cdot cm^{-3}$ at a contact time of 10 to 25 msec.

20. (original) The method of claim 11 wherein the hydrocarbon comprises a synthetic fuel made by the Fischer-Tropsch process and wherein, after passing through the reaction chamber, the hydrocarbon conversion has reached at least 70% of equilibrium conversion.

21. (previously presented) The method of claim 4 wherein the spinel support is in the form of a spinel layer disposed over a high surface area material.

22. (previously presented) The method of claim 21 wherein the high surface area material comprises gamma alumina.

23. (previously presented) The method of claim 16 wherein the catalyst comprises a spinel coating.

24. (previously presented) The method of claim 23 wherein the spinel coating is disposed over a high surface area material.

25. (previously presented) The method of claim 16 wherein the hydrocarbon has a contact time of 5-100 ms with the catalyst.

26. (previously presented) The method of claim 2 where the contact time in the reaction chamber is 10 to 25 ms.

27. (previously presented) The method of claim 4 where the contact time in the reaction chamber is 5 to 100 ms.

28. (previously presented) The method of claim 2 where the hydrocarbon consists essentially of methane.

29. (previously presented) The method of claim 4 where the hydrocarbon comprises methane.

30. (previously presented) The method of claim 13 where the hydrocarbon comprises methane.

31. (previously presented) The method of claim 15 where the porous interfacial layer comprises spinel or zirconia and the temperature in the reaction chamber is in the range of 500° to 1000°C.

32. (previously presented) The method of claim 4 wherein the temperature in the reaction chamber is at least 650 °C.

33. (previously presented) The method of claim 2 wherein the absolute conversion is at least 90%.

34. (previously presented) The method of claim 2 wherein the equilibrium conversion is at least 95%.

35. (previously presented) The method of claim 14 wherein the absolute conversion is at least 90%.

36. (previously presented) The method of claim 31 wherein the equilibrium conversion is at least 90%.

37. (previously presented) The method of claim 36 wherein the contact time is 5 to 100 ms.

38. (previously presented) The method of claim 1 wherein $H_2$ selectivity is at least 60%.

39. (previously presented) The method of claim 17 wherein $H_2$ selectivity is at least 50%.

40. (previously presented) The method of claim 18 wherein $H_2$ selectivity is at least 60%.

41. (previously presented) The method of claim 2 wherein $H_2$ selectivity is at least 85%.

42. (previously presented) The method of claim 33 wherein $H_2$ selectivity is at least 95%.

43. (previously presented) The method of claim 27 wherein the catalyst possesses a $H_2$ productivity of at least 0.7 $mmol \cdot s^{-1} \cdot cm^{-3}$.

44. (previously presented) The method of claim 43 wherein the hydrocarbon comprises methane.

45. (previously presented) The method of claim 3 wherein the $H_2$ productivity is 0.5 to 2 mmol $catalyst \cdot s^{-1} \cdot cm^{-3}$.

46. (previously presented) The method of claim 27 wherein the $H_2$ productivity is 0.5 to 2 mmol $catalyst \cdot s^{-1} \cdot cm^{-3}$.

47. (previously presented) The method of claim 3 wherein the catalyst comprises a zirconia support.

48. (previously presented) The method of claim 13 wherein the porous interfacial layer comprises zirconia.

49. (previously presented) The method of claim 1 wherein the catalyst has a corrugated form.

50. (previously presented) The method of claim 3 wherein the catalyst is disposed in the reaction chamber such that a gap is provided for flow past the catalyst.

51. (previously presented) The method of claim 50 wherein the reaction chamber is defined by a reaction chamber wall or reaction chamber walls, and wherein the catalyst is in close contact with a reaction chamber wall.

52. (previously presented) The method of claim 12 wherein the catalyst is disposed in the reaction chamber such that a gap is provided for flow past the catalyst.

53. (previously presented) The method of claim 1 wherein the hydrocarbon consists essentially of $C_1 - C_{10}$ alkanes; wherein hydrocarbon equilibrium conversion is at least 90% and $H_2$ selectivity is at least 60%.

54. (previously presented)The method of claim 53 wherein hydrocarbon equilibrium conversion is at least 99%, and wherein the reaction is conducted at a temperature in the range of 650-885 °C.

55. (previously presented)The method of claim 53 wherein the hydrocarbon consists essentially of methane; wherein hydrocarbon equilibrium conversion is at least 99% and $H_2$ selectivity is 100%.

56. (previously presented)The method of claim 4 wherein the hydrocarbon consists essentially of $C_1 - C_{10}$ alkanes; wherein hydrocarbon equilibrium conversion is at least 90% and $H_2$ selectivity is at least 60%.

57. (previously presented)The method of claim 56 wherein hydrocarbon equilibrium conversion is at least 99%, wherein the surface active sites comprise Rh, and wherein the reaction is conducted at a temperature in the range of 650-885 °C.

58. (previously presented)The method of claim 56 wherein the hydrocarbon consists essentially of methane; wherein hydrocarbon equilibrium conversion is at least 99% and $H_2$ selectivity is 100%.

## VIII. EVIDENCE APPENDIX

none

## APPENDIX OF RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.